

Revision of the Genus *Tricorythopsis* (Ephemeroptera: Leptoxyphidae) with the Description of Four New Species

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ABSTRACT

The genus *Tricorythopsis* Traver (1958) is revised and a new generic description is included. Females (imago and subimago) and nymph are described for the first time. Four new species are described: *T. fictilis* from Argentina, *T. volsellus* from Venezuela, *T. sigillatus* from Río de Janeiro St. (Brazil) and *T. petersorum* from Paraná St. (Brazil). The genus is reported for the first time from these countries and Ecuador. Keys to separate the genera (males and females) of the family Leptoxyphidae and male imagines of *Tricorythopsis* are included.

KEYWORDS: Ephemeroptera, Leptoxyphidae, South America, *Tricorythopsis*, generic keys, taxonomy.

INTRODUCTION

Leptoxyphidae is a New World family of Ephemeroptera (Peters & Peters, 1993) with 7 known genera. Among the members of this family, *Tricorythopsis* is one of the least known. Traver (1958) established it for the type species (*T. artigas*) based on male imagines from Uruguay and until now it was the only species in the genus. The genus was established because of the unique features of male genitalia (Fig. 26): distal segment of forceps conical and directed outwardly, and characteristic wing venation (see genus discussion below, Figs. 19, 29, 31, 36). Domínguez (1984) and Domínguez et al. (1992) gave keys to separate nymphs and adults of the leptoxyphid genera and Peters and Peters (1993) discussed some aspects of fore wing cubital venation.

In this paper four new species of *Tricorythopsis* are described, one for male imagines, female imagines and subimagines and nymph from Argentina, another for male and female imagines from Venezuela, another for male imagines and female subimagines from Paraná (Brazil), and another for male imagines from Río de Janeiro (Brazil). The female (imago and subimago) and nymph are described for the first time. It is therefore necessary to expand and modify the

generic description to include the missing life history stages and a new interpretation of male genitalia.

The genus is reported for the first time from Argentina, Venezuela, Brazil and Ecuador showing a wide range of distribution.

Generic keys for male and female imagines of Leptohiphidae are amended to include *Tricorythopsis*. A key to separate the nymphs is not proposed until some problems in the systematics of the family are resolved. A key for the male adults of *Tricorythopsis* is also proposed.

Genus *Tricorythopsis* Traver, 1958 (Figs. 1–37)

Tricorythopsis Traver, 1958: 491–492, Figs. 1, 2, 6, 8, 10 (male); Hubbard, 1990: 88; Domínguez et al., 1992: 24; Peters and Peters, 1993: 46.

Type species: Tricorythopsis artigas Traver, original designation.

Species included: T. artigas, T. fictilis sp. nov., *T. volsellus* sp. nov., *T. sigillatus* sp. nov. and *T. petersorum* sp. nov.

Distribution: Uruguay, Argentina, Venezuela, Brazil and Ecuador.

Imago. Length of ♂: body, 1.33–2.80 mm; fore wings, 1.68–2.80 mm. Length of ♀: body, 1.20–2.55; fore wing, 2.25–2.68 mm.

Head. Eyes laterally placed and separated on meson of head by distance equal to 4 times width of an eye. Median ocellus 1/4 width of lateral ocellus, placed frontally between antennae; lateral ocelli dorsolateral in position.

Thorax. Mesonotal filaments short and blunt or extending somewhat above the metanotum, attached only at the base of mesoscutellum, lateral margins being free.

Legs of ♂. Leg proportions: ratio femur I: femur II: femur III, 1: 0.8–1: 0.9–1; tibia+tarsus I: tibia+tarsi II: tibia+tarsus III, 1: 0.5: 0.6; femur I: tibia+tarsus I, 1: 1.8–2; femur II: tibia+tarsus II, 1: 1.1–1.3; femur III: tibia+tarsus III, 1: 1.2–1.3; tarsal claws I similar, both blunt (Fig. 21); each pair of tarsal claws II and III dissimilar, one blunt and other apically hooked (Figs. 22, 23).

Legs of ♀. Leg I with coxa and trochanter present only [other segments broken off and lost in all specimens (n > 200)], these segments directed anteriorly. Legs II and III directed backward, ending in two dissimilar tarsal claws, one blunt and other apically hooked. Femur III 1.13 times length femur II.

Wings. Fore wing of ♂ (Figs. 19, 29, 31, 36): vein ICuA curved toward vein CuP and usually joined to it forming a triangle, between these veins there is a detached cubital intercalary; a similar triad is present contiguously, formed by CuA and IMP2, with MP2 looking like an attached or detached intercalary between them. Outer and hind margins of fore wings with long setae (Figs. 36–37, omitted in the others). Fore wings of ♀ (Figs. 20, 30, 37) as in ♂ but with smaller cubitoanal lobe. Hind wings absent.

Abdomen. Male genitalia: forceps two-segmented, with projected posterolateral margins of styliger plate forming a slender base for each forceps, distal segment of forceps conical, shorter than basal segment and directed outwardly

(Figs. 18, 26, 27, 32, 35); cylindrical, conical or triangular penes, with (Fig. 35) or without (Figs. 18, 25–27, 32) sclerotized lateral margins.

Ninth sternum of ♀ apically blunt, with or without a superficial apical notch. Cerci of ♂ 2 times length of body, terminal filament 3 times length of body, with short setae at apex. Terminal filament and cerci of ♀ very short, reduced to a length not superior to that of the three last abdominal segments together; terminal filament slightly longer than cerci, all bearing short setae.

Female subimago. As female imago except that fore legs are present and directed forward, leg II and III directed backward. Each pair of tarsal claws of all legs dissimilar, one blunt, the other apically hooked.

Mature nymph (cuticle). Head hypognathous. [Antennae broken off and lost]. Mouthparts (Figs. 1–5): clypeus (Fig. 2) with lateral margins subparallel, maximum width of labrum 0.75 times maximum width of clypeus; length of labrum $\frac{1}{2}$ maximum width, lateral margins subparallel with widest part located at base (Fig. 2); anteromedian emargination shallow. Mandibles (Figs. 1, 3): outer margin almost straight. Maxillae (Fig. 4): galea-lacinia fused except on apical furrow; distal part with a tuft of a few hairs (6) on outer margin, and 5 spines at inner margin; palpi two-segmented, distal segment setiform. Labium (Fig. 5): palpi not extending beyond glossae; segment 1 of palpi 2.7 length of segment 2, segment 3 0.86 length of segment 2; glossae and paraglossae as in Figure 5.

Thorax. Legs (Figs. 12–15): [forelegs broken off and lost]. Leg proportions: femur II: femur III, 1: 1; tibia II: tibia III, 1: 1.27; tarsus II: tarsus III, 1: 1. Legs II and III with row of spines near base and on outer margin of femora, also a few scattered spines dorsally (Fig. 13); tibiae with a row of spines (Fig. 15) along inner margin; tarsi with few scattered setae; tarsal claws apically hooked with two parallel rows of denticles near apex (Figs. 6, 7).

Abdomen (Figs. 8–11, 16, 17). Gills (Figs. 8–11): gills on segments II–VI; gills on segment II operculate (Fig. 11), dorsal portion ovoid with a less sclerotized transversal band located $\frac{1}{2}$ distance from base, dorsal surface with tiny spines; ventral portion of gill II and gills on segments III–VI (Figs. 8–10) weaker and smaller than dorsal portion of gill II; without noticeable tracheae and with dissimilar dorsal and ventral lobes. Short posterolateral spines present on all abdominal segments, becoming larger toward posterior segments (Fig. 17). Posterior margin of terga with irregular denticles (Fig. 16). Caudal filament [just one present, others broken off and lost] as long as abdomen with whorl of setae in each intersegmental joint [broken at apex].

Observations. When shed, the subimaginal cuticle is light brownish-red, instead of grayish as in other genera of the family. The wings of imagines and subimagines of both sexes bear setae along outer and hind margins, these setae may be cut off but the trichogen cells are noticeable with a light microscope.

Discussion. The above redescription of *Tricorythopsis* is based on paratypes of *T. artigas* Traver, *T. fictilis* sp. nov., *T. volsellus* sp. nov., *T. sigillatus* sp. nov. and *T. petersorum* sp. nov. Aside from the four species here described, some specimens belonging to unnamed species of this genus have been collected from: 1 male imago, Venezuela, T.F.Amaz., Cerro de la Neblina, Basecamp 0°50'N 66°9'44"W, 140 m, 1–10 March 1984, D. Davis and T.McCabe; 1 male imago, Venezuela, T.F.Amaz., Cerro de la Neblina, Basecamp 0°51'N 66°10'W, 140 m, 13-15-III-1984, O. Flint and J. Louton; and about 200 females, Ecuador, Prov. Napo, Puerto Montufar., 26 Apr 1976, Blk. Lite, J. Cohen, Smithsonian collection. All material deposited in the National Museum of Natural History, Smithsonian Institution, Washington D.C. These are not described here because the material is not well preserved or is represented only by females.

As Peters and Peters (1993: 46) observed, in the fore wings of *Tricorythopsis petersorum* sp. nov. vein CuP may be joined or detached from IcuA (Figs. 36, 37). In the other species here described, CuP is strongly curved and united basally to vein IcuA (Figs. 19, 20, 29–31).

Tricorythopsis can be distinguished from all other genera of the Leptohiphidae by the following combination of characters. Imagines: (1) hind wings absent; (2) veins of Cu and MP sectors forming two consecutive triads, one formed by CuP and ICuA (with a detached intercalary vein between them) and the other formed by CuA and IMP with MP2 looking like an intercalary between them (Figs. 19–20, 29–31, 36–37); (3) styliger plate posteriorly projected forming a slender base for each forceps (Figs. 18, 26, 27, 32, 35); (4) two-segmented forceps with distal segment conical and directed outwardly (Figs. 18, 26, 27, 32, 35); (5) females with very short cerci and terminal filament, not surpassing the length of the last three abdominal segments combined; (6) fore legs present in female subimago but absent in female imago, except for coxae and trochanters. Nymph: (1) gills present on abdominal segments II–VI (Figs. 8–11); (2) operculate gill on segment II ovoid with a transversal weaker band at middle (Fig. 11); (3) anteromedian emargination of labrum shallow (Fig. 2); (4) without tubercles on head, thorax or abdomen; (5) relatively small nymphs, not surpassing 2 mm in length; (6) tarsal claws with two subparallel rows of denticles near apex (Figs. 6, 7).

KEY FOR THE GENERA OF LEPTOHYPHIDAE

Males

- | | | |
|---|--|----------------------------|
| 1 | Hind wings present | 2 |
| – | Hind wings absent | 3 |
| 2 | Forceps three-segmented | <i>Leptohiphes</i> Eaton |
| – | Forceps two-segmented | <i>Haplohiphes</i> Allen |
| 3 | Compound eyes of male large, almost covering the head | <i>Leptohiphodes</i> Ulmer |
| – | Compound eyes of male smaller, not covering head | 4 |
| 4 | Forceps one-segmented and short, shorter than last abdominal segment | <i>Cotopaxi</i> Mayo |
| – | Forceps two- or three-segmented | 5 |

- 5 Forceps two-segmented (Figs. 18, 26, 27, 32, 35); vein IMP longer than vein MP2 and united basally to vein CuA (19, 20, 29-31, 36, 37) *Tricorythopsis* Traver
 – Forceps three-segmented; vein IMP shorter or subequal to vein MP2 and not united basally to vein CuA *Tricorythodes* Ulmer

Females

- 1 Hind wings present *Haplohyphes* Allen
 – Hind wings absent 2
 2 Mesonotal filaments short (not extending beyond posterior margin of abdominal tergum I), even width along its length 3
 – Mesonotal filaments long and slender (reaching posterior half of abdominal tergum II or III), becoming thinner toward apex 4
 3 Cerci and terminal filament very short (not longer than last three abdominal segments combined); vein IMP longer than vein MP2 and united basally to vein CuA (Figs. 20, 30, 37)
 *Tricorythopsis* Traver
 – Cerci longer than last eight abdominal segments combined, terminal filament at least as long as body; vein IMP shorter or subequal to vein MP2 and not united basally to vein CuA
 *Tricorythodes* Ulmer
 4 Legs long and slender, legs III almost as long as body; abdominal sternum IX strongly projected posteriorly *Leptoxyphodes* Ulmer¹
 – Legs relatively shorter, legs III shorter than body; abdominal sternum IX not strongly projected *Leptoxyphes* Eaton¹

KEY FOR THE MALE IMAGINES OF *TRICORYTHOPSIS*

- 1 Lateral margins of penes distinctly sclerotized (Fig. 35); vein CuP of fore wing some times detached from base (Fig. 36) *T. petersorum* sp. nov.
 – Penes without sclerotized lateral margins (Figs. 18, 25-27, 32); vein CuP attached to ICuA at base (Figs. 19, 20, 29-31) 2
 2 Forceps base as long as forceps segment 1, forceps relatively short and strong; penes lobes apically rounded (Figs. 18, 26, 32) 3
 – Forceps base short (less than ½ length of forceps segment 1), forceps long and slender; penes lobes apically acute and curved inwardly (Fig. 27); mesonotal marks as in Fig. 28
 *T. volsellus* sp. nov.
 3 Penes divided on apical 1/6 or less (Figs. 26, 32) 4
 – Penes divided on apical 1/3 or 1/4 (Figs. 18, 25) *T. ficitilis* sp. nov.
 4 Penes conical, with the distal apex 1/5 of basal width (Fig. 26); body cuticle with reddish and blackish marks (specimens are too faded for distinguish mesonotal marks) *T. artigas* Traver
 – Penes cylindrical, with a similar width along their length (Fig. 32); body cuticle with blackish marks only; mesonotal marks as in Figure 33 *T. sigillatus* sp. nov.

***Tricorythopsis artigas* Traver (1958) (Fig. 26)**

Tricorythopsis artigas Traver, 1958: 492–494, Figs. 1, 2, 6, 8, 10 (male); Hubbard, 1990: 88.

Some paratypes of this species were studied, changes to Traver's description are not necessary. Specimens are very faded following long immersion in alcohol; cuticle marks are no longer visible, comments on this aspect are extracted from Traver (1958). The original description is adequate, only short notes on distinc-

1. The separation of *Leptoxyphodes* and *Leptoxyphes* using these characters is still doubtful because it was not possible to observe material of *Leptoxyphodes*.

tion of this species and a figure of male genitalia are included in the present paper, figures of wings, legs and genitalia are in Traver (1958: 493).

Discussion. Male imagines of *T. artigas* Traver can be separated from the other species of the genus by the following combination of characters: (1) body cuticle with reddish and blackish marks; (2) forceps base long, similar in length to forceps segment 1 (Fig. 26); (3) penes divided on apical 1/12 (Fig. 26); (4) penes conical, with wide base and becoming narrower toward apex (Fig. 26); (5) lateral margins of penes not sclerotized.

Female and nymphs. Unknown.

Material. Paratypes studied: 9 male imagines from URUGUAY, Artigas, Sepulturas, 13-I-1952, C.S. Carbonell Col. Wings and genitalia from three of these paratypes on slides. The material is deposited in the Entomological Collections of Facultad de Humanidades y Ciencias del Uruguay.

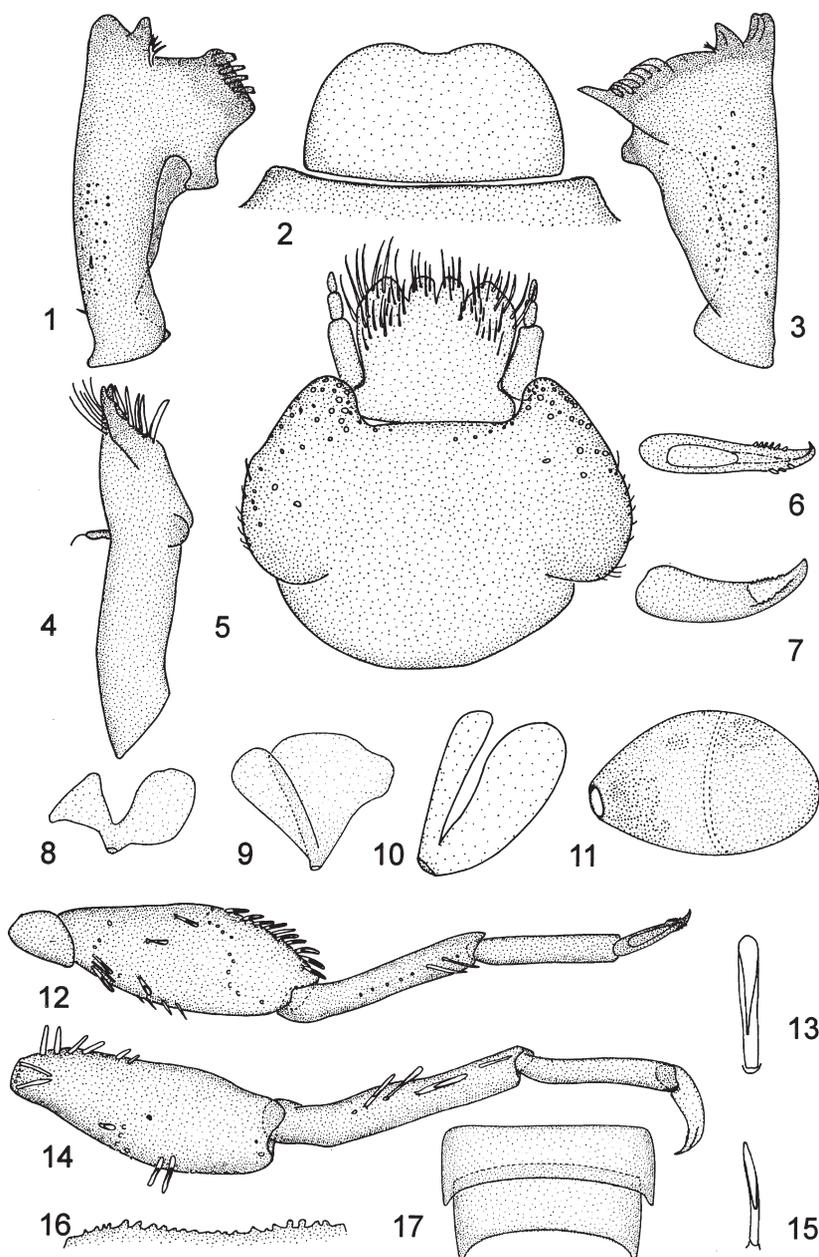
Tricorythopsis fictilis sp. nov. (Figs. 1–25)

Male imago (in alcohol). Length: body, 1.90–2.10 mm; fore wings, 2.00–2.25 mm. General coloration whitish-yellow with blackish and reddish marks.

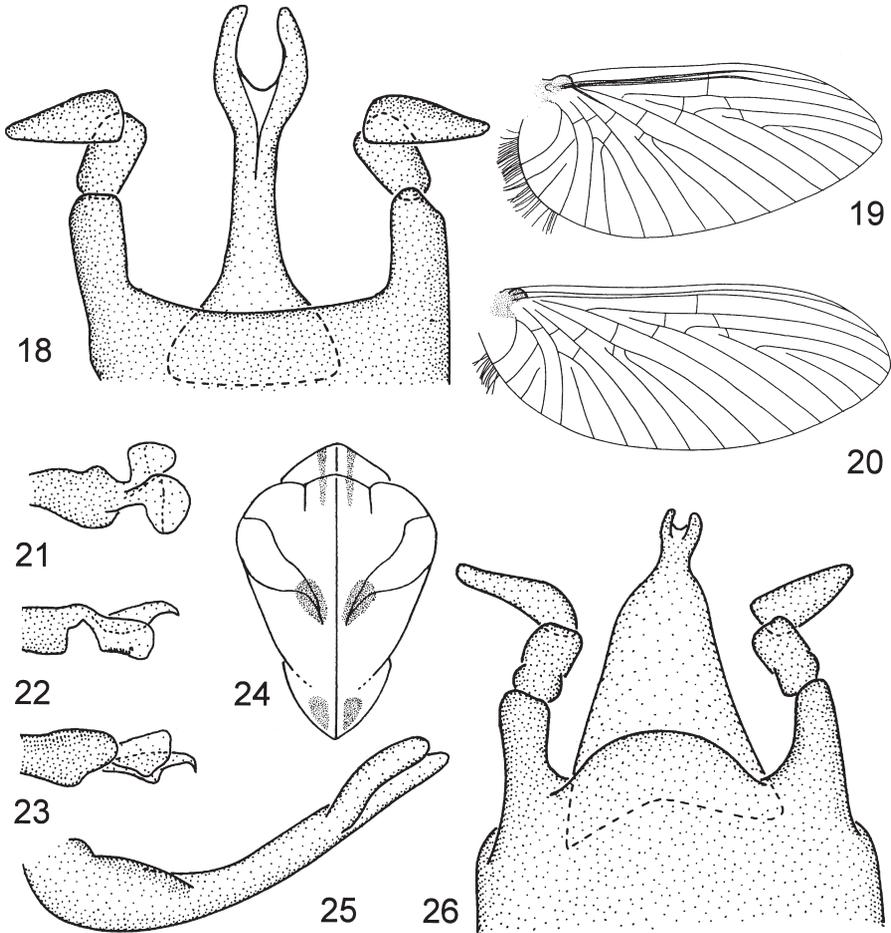
Head. Whitish shaded with grayish on posterodorsal and lateroventral regions, and with reddish on sublateral regions. Antennae whitish rounded with black at base, pedicel 2 times length of scape, flagellum as long as two other segments combined. Cervical membrane widely tinged with black.

Thorax. Pronotum transparent amply tinged with reddish, posterior margin blackish; propleura and base of coxae I tinged with black; prosternum whitish. Mesonotum whitish-yellow with a pair of diffuse blackish longitudinal bands between mesonotal protuberance and anterior zone of mesoscutum; two submedian blackish marks at points of union of inner and outer parapsidal sutures, and with two submedian reddish marks on mesoscutellum (Fig. 24); mesopleura and mesosterna translucent yellowish white with margins and carinae light gray. Metanotum and metapleura yellowish white, metasternum whitish translucent. Legs. Whitish except tibiae I and tarsi I whitish translucent; coxae, tibiae and tarsi of fore legs shaded with gray; all femora with a grayish subapical band. Wings (Fig. 19). Membrane of fore wings hyaline, longitudinal veins hyaline except vein Sc and veins of R sector shaded with gray, cross veins hyaline except those in median region of Sc and R sectors shaded with gray.

Abdomen. Segments I–VIII translucent, IX–X whitish; terga III–IX with blackish mediolongitudinal band; terga I–V and VII with blackish lateral zones (on V these marks are smaller and nearer the median band); tergum VIII widely tinged with black, lateral zones of VIII–IX reddish; tergum X with grayish anterior margin and mediolongitudinal line. Abdominal sterna translucent without marks except blackish posterior margin and circular median mark on sterna VI–VIII.



Figs. 1-17. *Tricorythopsis fictilis*, nymph. 1-5, mouthparts: 1, right mandible, dorsal view (d.v.); 2, clypeus and labrum, d.v.; 3, left mandible, d.v.; 4, right maxilla, ventral view (v.v.); 5, labium, v.v.; 6, tarsal claw II, v.v.; 7, tarsal claw III, v.v.; 8-11, gills: 8, gill V; 9, gill IV; 10, gill III; 11, gill II (operculate gill); 12-15, legs: 12, leg II, d.v.; 13, femoral spine (detail); 14, leg III, d.v.; 15, tibial spine (detail). 16-17, abdomen: 16, hind margin of tergum VII (detail); 17, terga VII-VIII, d.v.



Figs. 18–26. 18–25, *T. fictilis*: 18, ♂ genitalia, v.v.; 19, ♂ fore wing; 20, ♀ fore wing; 21–23, ♂ tarsal claws I–III, lateral view (l.v.); 24, mesonotal marks; 25, penis, l.v.. 26, *T. artigas* Traver: ♂ genitalia, v.v.

Genitalia (Fig. 18): styliiger plate translucent yellowish-white, distal part of penes hyaline; penes slender, divided on apical $\frac{1}{3}$ – $\frac{1}{4}$, slightly curved upwardly (Figs. 18, 25). Cerci whitish translucent, slightly shaded with gray, hyaline at articulations.

Female imago (in alcohol). Length: body, 1.38–1.50 mm; fore wings, 2.25–2.50 mm. General coloration yellowish-white.

Head. Light yellowish-white, with blackish bands between eyes and antennae; on ventral side with a blackish H-shaped mark. Antennae as in male [flagellum broken off and lost]. Cervical membrane tinged with black.

Thorax. Prothorax whitish translucent, slightly tinged with red on lateral regions of pronotum and with black on pleura. Mesonotum yellowish-white with carinae and margins darker; with two submedian longitudinal blackish bands between mesonotal protuberance and anteromedian zone of mesoscutum; mesopleura yellowish-white tinged slightly with blackish on membranes; mesoscutum with light reddish median zone and with reddish submedian marks on mesoscutellum. Membranous filaments of mesoscutellum slightly yellowish, longer than wide. Metathorax whitish with grayish margins. Thoracic sterna whitish except sternal sutures between pro- and mesosternum and between meso- and metasternum shaded with gray. Legs. Legs I: coxae and trochanters whitish; legs II and III whitish, tinged with black on tarsi and subapical zones of femora and tibiae. Wings (Fig. 20). Membrane of fore wings hyaline slightly tinged with gray at base; veins hyaline except base of vein C, basal 2/3 of vein Sc and vein R1 and cross vein on R sector shaded with gray.

Abdomen. General coloration whitish translucent turning yellowish-white when full of eggs; terga IV-IX with blackish median zone; terga IV, VII and VIII with blackish sublateral zones (wider on IV); pleural fold of segments I-IX and lateral zones of sterna I-IX near pleural folds blackish. Cerci whitish translucent similar in length to two or three last abdominal segments together; terminal filament slightly longer than cerci. Ninth sternum entire, apically truncated.

Female subimago (in alcohol). Length: body, 2.55 mm; fore wings, 2.68 mm. General coloration whitish-yellow.

Head. As in female imago except tinged with red behind eyes.

Thorax. Mesonotal marks as in male (Fig. 24). Legs: whitish, leg I directed forward, legs II and III directed backward. Wings as female imago.

Abdomen. Whitish turning yellowish-white where eggs are present; lateral zones of tergum IV and median zone of IX blackish. Ninth sternum apically truncated, with a concave posterior margin. Cerci yellowish translucent, similar to female imago.

Mature nymph (cuticle in alcohol, mouthparts and legs on slide). The only visible marks on the shaded cuticle are on abdominal terga II-VIII. These terga are brownish yellow with a pair of whitish translucent sublateral circular marks on terga V-VIII.

Observations. Male imagines: the reddish marks on mesoscutellum and the blackish marks on the mesoscutum may not be visible in some faded specimens; in others these marks are more extensive and diffusely shaded with red. Female imagines: the female paratypes from Mado (Misiones, Argentina) differ from the allotype in the general coloration, being whitish-yellow with heavier marks. Further, the ninth sternum is entire and truncated apically; one of the females has a slightly concave posterior margin.

Material. *Holotype male imago*, ARGENTINA, Misiones, Bompland, 15/II/1985, E. Domínguez col.. *Allotype female imago*, same data as holotype. Paratypes: 49 male imagines and 1 female imago, same

data as holotype; 45 male imagines and 1 female subimago, ARGENTINA, Misiones, Alegría, Piray-Guazú, 3–4/XII/1986, E. Domínguez col.; 1 male imago and 5 female imagines, ARGENTINA, Misiones, Mado, 16/II/1985, E. Domínguez col. All material deposited in the collections of Instituto-Fundación Miguel Lillo, Tucumán, Argentina except 5 male imagines in National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA and 5 male imagines in Florida A&M University, Tallahassee, Florida, USA. Association of nymph and adults made by rearing by Dr. E. Domínguez.

Etymology. From the Latin word '*fictilis*' meaning 'earthen' or 'made of clay', for the reddish marks on the cuticle.

Discussion. Adults of *T. fictilis* can be distinguished from the others species of the genus by the following combination of characters: (1) body cuticle with reddish and blackish marks; (2) mesonotal marks as in Figure 24, anterior pair blackish and posterior pair reddish; (3) forceps base long, similar in length to forceps segment 1 (Fig. 18); (4) penes divided on apical $\frac{1}{3}$ – $\frac{1}{4}$ (Figs. 18, 25); (5) lateral margins of penes not sclerotized; and 6) female with cerci as long as the three last abdominal segments combined.

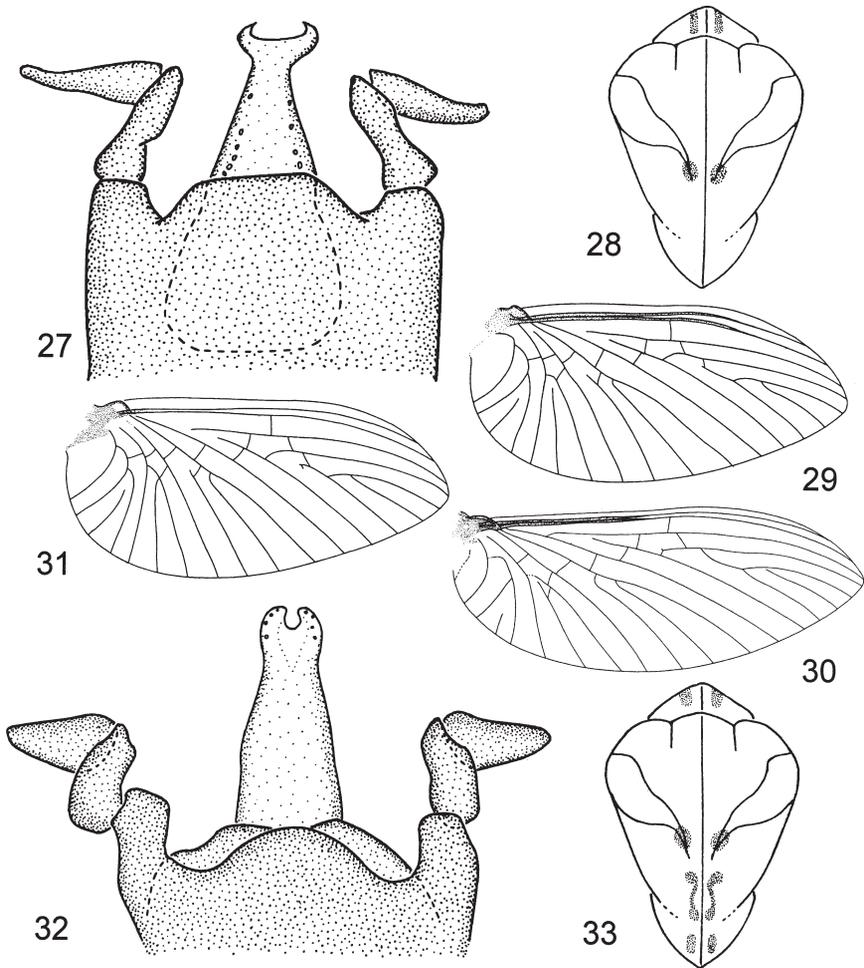
***Tricorythopsis volsellus* sp. nov. (Figs. 27–30)**

Male imago (in alcohol). Length: body, 1.33–2.05 mm; fore wings, 1.68–1.78 mm. General coloration light orangish-yellow, abdomen whitish translucent.

Head. Whitish-yellow with a transverse blackish band between eyes, band interrupted on meson of head. Antennae yellowish-white turning whitish translucent toward apex, scape $\frac{1}{3}$ length of pedicel, apex of pedicel grayish; flagellum whitish translucent, 2 times length of head.

Thorax. Prothorax light yellowish translucent, except sternum whitish translucent; shaded with blackish on pronotum, heavier on anterior margin. Mesothorax light orangish-yellow, paler on mesopleura and mesosternum, except lateral sclerites of mesosternum yellowish; two black submedian bands on mesonotal protuberance and on the point of union of inner and outer parapsidal sutures forming an oval mark on each side (Fig. 28); pleural and sternal carinae grayish; mesoscutellum yellow. Metathorax whitish-yellow except metapleura and lateral zones of metasternum yellowish translucent shaded diffusely with gray on carinae. Legs. Legs I: coxae, trochanters and femora yellowish-white; tibiae, tarsi, subapical irregular mark on femora and tarsal claws I grayish. Legs II and III yellowish-white, femora with grayish subapical band. Wings (Figs. 29, 30). Membrane of fore wings hyaline, veins whitish translucent except costal brace, veins Sc and R shaded with gray; cross veins whitish translucent except those on R sector shaded with gray.

Abdomen. Whitish translucent except segments VIII–X yellowish-white; terga I–IX with a small grayish anteromedian mark and bigger grayish lateral marks, marks more extensive on IV and VII; pleural fold of segments I–IX with blackish marks, heavier on II; tergum X with yellowish median longitudinal band and posterior margin; sterna diffusely shaded with grayish turning darker at lateral margins.



Figs. 27–33. 27–30, *T. volsellus*. 27, ♂ genitalia, v.v.; 28, mesonotal marks; 29, ♂ fore wing; 30, ♀ fore wing. 31–33, *T. sigillatus*. 31, ♂ fore wing; 32 ♂ genitalia, v.v.; 33, mesonotal marks.

Genitalia (Fig. 27): styliger plate whitish with yellowish margins and grayish median longitudinal band; forceps whitish translucent, penes hyaline with yellowish translucent margins and base. Cerci translucent, with short setae on apex.

Female imago (in alcohol). Length: body, 1.20–1.75 mm; fore wings, 2.30–2.50 mm. General coloration whitish-yellow, abdomen whitish translucent.

Head. As in male except antennae whitish translucent, pedicel 2 times length of scape, flagellum as long as head.

Thorax. As in male except shaded with blackish more extensively, shaded heavier on pronotum, union zone of parapsidal sutures, and mesoscutellum. Legs. Legs I: coxae and trochanters yellowish, base of coxae grayish; legs II and III yellowish-white directed backward, darker on trochanters and base of femora; legs III slightly larger than II. Wings (Fig. 30). As in male except cubitoanal lobe less extended.

Abdomen. Whitish translucent except segments IX-X whitish; terga II-VI with blackish median zone and terga I-III with blackish lateral margins. Ninth sternum entire and apically truncated. Cerci: whitish translucent, bearing small setae; terminal filament slightly longer than cerci, none of them longer than abdominal segment X.

Nymph. Unknown.

Observations. In some male imagines the blackish marks on the abdomen are faded except those on lateral sides of terga IV-VII, anteromedian marks on I-IX and on pleural membrane of segment II. One of the female paratypes has lighter subapical blackish marks on femora II and III. Allotype and almost all female paratypes have some remnants of subimaginal cuticle (light brownish) on base of wings and other parts of thorax or abdomen, also a male imago presents remnants on fore tarsal claw.

Material. *Holotype male imago*, VENEZUELA, TFA, Río Negro, San Carlos de Río Negro, 5-12/III/1984, O. Flint & J. Louton cols. Allotype female imago, same data as holotype. Paratypes: 5 male imagines and 5 female imagines, same data as holotype. All material deposited in the collections of National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA except for 2 ♂ and 2 ♀ paratypes in Instituto- Fundación Miguel Lillo, Tucumán, ARGENTINA.

Etymology. Masculinization of the Latin word '*volsella*' meaning 'tongs' or 'tweezers' because of the shape of penes.

Discussion. Adults of *T. volsellus* can be separated from the other species of the genus by the following combination of characters: (1) body cuticle with blackish marks; (2) mesonotal marks as in Figure 28; (3) forceps base short, less than ½ length of forceps segment 1 (Fig. 27); (4) forceps long and slender (Fig. 27); (5) penes lobes acute apically and directed inwardly (Fig. 27); (6) lateral margins of penes not sclerotized; and (7) cerci of females with a length not surpassing that of abdominal segment X.

Tricorythopsis sigillatus sp. nov. (Figs. 31-33)

Male imago (in alcohol). Length: body, 1.50-2.13 mm; fore wings, 1.80-1.98 mm. General coloration yellowish-white, abdomen whitish translucent with blackish marks.

Head. Yellowish-white, turning whitish ventrally, shaded with black posterior to lateral ocelli, on medial line, and between base of antennae and compound

eyes; on ventral side with a black H-shaped mark. Antennae: scape whitish tinged with yellowish, pedicel whitish translucent, flagellum hyaline $2\frac{1}{2}$ times length of head.

Thorax. Prothorax hyaline extensively shaded with blackish, stronger on medial line, lateral sides and posterior margin of pronotum; turning whitish toward prosternum. Mesothorax yellowish turning whitish on pleura and whitish translucent on mesosternum; mesonotum (Fig. 33) with carinae and margins orangish-yellow, with two submedian longitudinal blackish bands between mesonotal protuberance and median zone of mesoscutum, point of union of inner and outer parapsidal sutures blackish, submedian S-shaped blackish marks between mesoscutum and mesoscutellum; mesoscutellum yellowish translucent with submedian grayish marks, bearing two short and blunt membranous filaments; pleura with grayish carinae; sternum with anterior margin of basisternum and furcasternum grayish, darker on the suture between both sclerites. Metathorax whitish-yellow with grayish anterior margin and lateral zones. Legs. Yellowish-white with base of coxae grayish, remaining segments of all legs whitish translucent, legs I diffusely shaded with gray, femora of all legs with a subapical grayish band. Wings (Fig. 31). Membrane of fore wings hyaline, veins whitish translucent except veins Sc, R1 and cross veins of R sector shaded with gray.

Abdomen. Whitish translucent with blackish marks, segment IX–X yellowish-white; blackish marks present on mediodorsal zones of terga II–IX, these marks circular on anterior segments turning ovoid on posterior ones; wider marks on lateral zones of segments I–IX, except segment VI, and heavier on IV and VII, on V marks nearer center of tergum; tergum X darker on medial line and with two submedian diffuse grayish marks on posterior margin; small circular marks on pleural folds II–IX. Sterna whitish translucent with small circular blackish marks on lateral margins near to pleural marks; sterna VII–VIII with grayish anterior margin.

Genitalia (Fig. 32): styliger plate whitish with anterior and lateral margins grayish; forceps and penes whitish translucent, except distal part of penes hyaline. Cerci translucent, with light gray basal segment and articulations.

Female and nymph. Unknown.

Material. Holotype male imago, BRAZIL, Rio de Janeiro, Mun. Rio Claro, Rio Pirai, 8-IV-1977, C. M. & O.S. Flint, Jr. cols. Paratypes: 38 male imagines, same data as holotype. All material deposited in the collections of National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA, except 5 ♂ imagines in Instituto-Fundación Miguel Lillo, Tucumán, ARGENTINA.

Etymology. From Latin '*sigillatus*', meaning, 'adorned with little figures or marks', because of the mesonotal marks.

Discussion. Male imagines of *T. sigillatus* can be separated from the other species of the genus by the following combination of characters: (1) body cuticle with blackish marks; (2) mesonotal marks as in Fig. 33; (3) forceps base long, similar in length to forceps segment 1 (Fig. 32); (4) penes divided on apical $1/6$ or less

(Fig. 32); (5) penes cylindrical, with even width in entire length (Fig. 32); (6) penes without sclerotized lateral margins.

Tricorythopsis petersorum sp. nov. (Figs. 34–37)

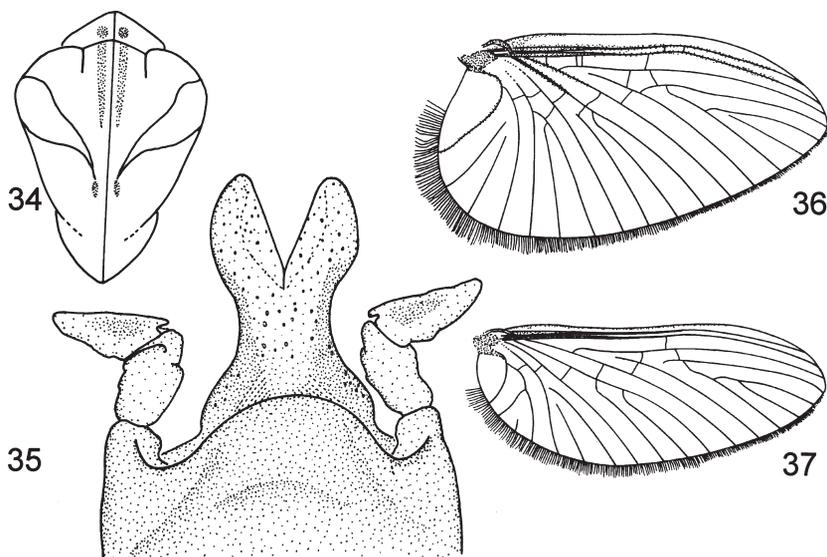
Male imago (in alcohol). Length: body, 2.40–2.80 mm; fore wings, 2.50–2.80 mm. General coloration brownish-yellow, abdomen yellowish-translucent with light gray marks.

Head. Light brownish-yellow; yellowish-white between eyes and antennae; with a yellowish-white T-shaped mark on the occiput. Antennae: scape whitish-translucent with yellow basal rings; basal half of pedicel yellowish-translucent, distal half whitish-translucent, flagellum apparently two-segmented and 2 times length of head, first segment whitish-translucent, second segment hyaline and 2 times length of the first segment. Cervical membrane whitish-translucent.

Thorax. Pronotum whitish-translucent with gray posteromedian zone and brownish-yellow lateral zones; propleurae hyaline; anterior half of prosternum whitish-translucent, posterior half yellowish-translucent. Mesonotum brownish-yellow with black margins and carinae; with blackish markings as follows (Fig. 34): a pair of submedian circular marks on mesonotal protuberance, a pair of longitudinal submedian bands on anterior half of scutum and with a pair of submedian oval marks on the point of union between inner and outer parapsidal sutures; mesopleurae light brownish-yellow with whitish membranes; mesosternum whitish-yellow with brownish-yellow lateral sclerites; mesoscutellum yellowish-translucent with a pair of short and thin membranous filaments not extending beyond metanotum. Metanotum brownish-yellow, metapleurae and metasternum light brownish-yellow with whitish membranes. Legs. Coxae and trochanters of all legs light brownish-yellow; femora of all legs yellowish-white with brownish margins; distal half on the dorsum of fore femora light brownish-yellow; fore tibiae and tarsi whitish, middle and hind tibiae brownish-yellow turning whitish yellow toward ventral side; middle and hind tarsi yellowish-white turning whitish-translucent toward apex. Wings (Fig. 36). Membrane of fore wings hyaline, veins whitish-translucent except veins Sc and R1 shaded with gray, and veins MA1 and those on radial sector very slightly shaded with gray; cross veins hyaline; costal brace and basal sclerites light brownish-yellow.

Abdomen. Light brownish-yellow very slightly shaded with gray, with yellowish-white intersegmental membranes. Terga I–IX light brownish-yellow with whitish-yellow mediolongitudinal band; tergum X yellowish-white with mediolongitudinal band and posterior half brownish-yellow. Sterna brownish-yellow.

Genitalia (Fig. 35): styliiger plate whitish-yellow with margins and anterior half light brownish-yellow; forceps translucent light yellowish-white except distal segment grayish; penes whitish translucent with sclerotized lateral margins brownish-yellow, distal part of penes hyaline. Cerci whitish-translucent, with light gray articulations.



Figs. 34–37. *T. petersorum* sp. nov. 34, mesonotal marks; 35, ♂ genitalia, v.v.; 36, ♂ fore wing; 37, ♀ fore wing.

Female imago and nymph. Unknown.

Female subimago (in alcohol). Length: body, 2.25 mm; fore wings, 2.50 mm. General coloration light brownish-yellow.

Head. As in male except whitish mark on occiput more extensive.

Thorax. As in male except wider membranous filaments on mesoscutellum, curved medially and reaching abdominal segment I. Legs. As in male except fore femora yellowish-white with margins light brownish-yellow and fore tibiae and tarsi light brownish-yellow. Wings (Fig. 37). Membrane of fore wings slightly whitish-translucent, longitudinal veins slightly gray, cross veins translucent.

Abdomen. Terga I–X translucent yellowish-white very slightly washed with gray; terga I–III with yellow lateral margins. Sterna translucent yellowish-white, sterna I–IV with whitish mediolongitudinal band, sterna V–VII with a grayish mediolongitudinal band, sterna VIII–IX with yellowish lateral margins and with small posterolateral projections, IX sternum turning hyaline toward posterior margin and ending in a yellowish transversal band; posterior margin slightly concave. Cerci and terminal filament translucent yellowish-white completely covered with setae, not longer than the two last abdominal segments combined; terminal filament slightly longer than cerci [cerci and terminal filament apically broken].

Material. Holotype male imago, BRAZIL, Paraná St., Rio Ipiranga, 730 m, 21–13–II–1969, W.L. & J.G. Peters. Allotype female subimago and 49 paratypes male imagines same data as holotype. Holotype, allotype and 8 male paratypes deposited in Museu de Zoologia da Universidade de Sao Paulo,

Sao Paulo, Brazil; 30 male paratypes in Instituto-Fundación Miguel Lillo, Tucumán, Argentina and 30 male paratypes in Florida A & M University, Tallahassee, Florida, USA.

Etymology. This species is dedicated to Dr William L. and Dr Janice G. Peters, who collected the material and kindly offered it to be included in the present paper.

Discussion. Male imagines of *T. petersorum* can be distinguished from the other species of the genus by the following combination of characters: (1) body cuticle without strong marks, only with grayish marks; (2) mesonotal marks as in Fig. 34; (3) forceps base short, about as long as $\frac{1}{2}$ length of forceps segment 1 (Fig. 35); (4) penes divided on apical $\frac{1}{3}$ - $\frac{1}{2}$ (Fig. 35); (5) lateral margins of penes brownish-yellow, distinctly sclerotized.

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REFERENCES

- Domínguez E (1984): Dos especies nuevas del genero *Haplohyphes* Allen (Ephemeroptera: Tricorythidae) de la Argentina. *Rev Soc Entomol Argentina*, 43(1-4): 103-112.
- Domínguez E, Hubbard MD, Pescador ML (1992): Clave para ninfas y adultos de las familias y géneros de Ephemeroptera (Insecta) sudamericanos. *Biología Acuática No. 16, Instituto de Limnología "Dr Raúl A Ringuelet" UNLP-CONICET, La Plata, Buenos Aires, Argentina, 142 pp.*
- Hubbard MD (1990): Mayflies of the World: A Catalog of the Family and Genus Group Taxa (Insecta: Ephemeroptera). *Flora and Fauna Handbook No 8, Sandhill Crane Press, Inc Gainesville, Florida, USA.*
- Peters WL, Peters JG (1993): Status changes in Leptohiphidae and Tricorythidae (Ephemeroptera). *Aquatic Insects* 15(1): 45-48.
- Traver RJ (1958): The subfamily Leptohiphinae (Ephemeroptera: Tricorythidae). *Ann Entomol Soc Amer* 51(5): 491-503.